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Telemedicine is not a gimmick. It is slowly becoming a viable tool in the delivery of modern day healthcare. Healthcare executives, providers, and politicians must start working together to enhance the progression of Telemedicine within the DoD/Military Healthcare System.

The uses of telecommunication technology in the delivery of medical care and information are endless. We live in a "High Tech" world that is growing by leaps and bounds leaving a system grasping for rules and guidelines to show us the way. The literature speaks of telemedicine as a rebirth of the modern day "house call", but lacks a framework of Structure, Process, and Outcome.

This research focused on the cost avoidance issue of "who saves" and "how much can be saved." By gathering data through the Composite Healthcare System (CHCS) it was possible to group patients via their originating MTF site. Using the Delphi Technique a panel of experts reviewed the data and determined that 36% or 780 patients out of 2,156 medevacs could have been treated via the telemedicine system. This represents an annual saving to DoD of approximately $4 million dollars.

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In Health Care Administration

A Cost Benefit Of Telemedicine:
An Assessment Of Aero-medical Evacuation Patients
Throughout The Pacific Basin

Graduate Management Project

Submitted To The Faculty Of Baylor University

In Fulfillment Of The Degree Of

Master Of Health Administration

By

Lieutentant Dan Cornwell, MSC, USN

Tripler Medical Center
Honolulu, Hawaii

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I am very proud of this project; during a recent Telemedicine Conference my findings were presented at the Medical College of Georgia and the University of Kentucky. In addition to the presentations I have prepared and submitted two articles for publication.

My most heartfelt thanks are reserved for fellow classmate Major Patrick Tracy who has guided me through a year of change and growth. I could have never completed this intense program without his and all the past and present Baylor students support and understanding.

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Abstract

Telemedicine is not a gimmick. It is slowly becoming a viable tool in the delivery of modern day healthcare. Healthcare executives, providers, and politicians must start working together to enhance the progression of Telemedicine within the DoD/Military Healthcare System.

The uses of telecommunication technology in the delivery of medical care and information are endless. We live in a "High Tech" world that is growing by leaps and bounds leaving a system grasping for rules and guidelines to show us the way. The literature speaks of telemedicine as a rebirth of the modern day "house call", but lacks a framework of Structure, Process, and Outcome.

Many of the barriers--licensure, reimbursement, and credentialing are major factors as to why a solid framework is not in place. While these barriers frustrate and politically drain the civilian sector, DoD healthcare already has in place a "system wide" method of licensure, credentialing, and reimbursement. Although reimbursement is and will continue to be an evolving process as the use of telemedicine expands, the issue of "who pays" and "how much" will only muddy the waters.

This research focused on the cost avoidance issue of "who saves" and "how much can be saved." By gathering data through the Composite Healthcare System (CHCS), it was possible to group patients via their originating MTF site. Using the Delphi Technique a panel of experts reviewed the data and determined that 36% or 780 patients out of 2,156 medevacs could have been treated via the telemedicine system. This represents an annual saving to DoD of approximately $4 million.

Chapter I

Introduction

The history of telemedicine is relatively short, dating back only to about 1959 and could be described as a series of exploratory pilot projects with limited long-term continuity (Preston Et Al 1992). As with many new technologies, it has struggled with changing (improving) technology, costs associated with new ideas, and acceptance of new approaches by people accustomed to the familiar.

As one reviews the literature, however, it is striking how the vast majority of patients and practitioners who actually experience telemedicine find it to be effective and useful. The major focus of these experiments has been on telemedicine as a vehicle for extending high quality medical care to people in remote areas to improve access to care and minimize the travel time of health care providers. Clearly, it has the potential to play an important role in such situations (Tangalos 1993).

The four essential characteristics of telemedicine systems include: 1) The geographic separation between physician and patient during the clinical encounter (Telediagnosis) or between two or more physicians during a consultation (Teleconsultation), 2) The use of telecommunication and computer technology to enable, facilitate, and possibly enhance the interaction between provider and client (or provider and provider) as well as the transfer of information, 3) The staffing of appropriate manpower to perform all the necessary functions within such systems, and

4) The development of an organizational structure uniquely suitable for implementing telemedicine systems. Two additional parameters were considered important for maximizing the effectiveness of telemedicine systems, namely, the development of clinical protocols for triaging patients to appropriate diagnostic and treatment sources and the development of normative standards of behavior to replace the norms of face-to-face contact between patient/provider and provider/provider (Bashshur 1991).

Description Of The Organization

Tripler Medical Center (TMC) is a 421-bed acute and tertiary care facility. It is one of the first tri-service Department of Defense Medical Treatment Facilities operating within the Military Health Care System (MHCS). TMC's vision is: "To be the premier health care system in the Pacific Basin." This vision will be accomplished by integrating the best in modern *Technology*, seeking innovative ways to *Adapt* to the future. achieving excellence in *Medical* education, and providing responsive *Caring* health services wherever and whenever needed. TMC is the only federal hospital in Hawaii, and supports active duty and beneficiary populations including veterans from all elements of the United States Armed Forces. This population is estimated to be 279,000. Additionally, there is a referral population of 579,392 comprised of United States Pacific Command military and dependents, Department of Veterans Affairs beneficiaries, and qualified Pacific Island Trust Territory beneficiaries. This large beneficiary population results in over 3,000 outpatient clinic visits per day and discharges nearly 2,000 inpatients per month (Lowe 1994).

TMC's health care system for fiscal year 1994 cared for 916,065 outpatient visits, admitted 21,700 beneficiaries of DoD personnel, for total bed days of 116,106, with an average Length of Stay of 5.4 days, and delivered 2,966 babies. In the area of ancillary services TMC filled 1,623,448 prescriptions, drew 15,941,657 laboratory specimens, and performed 2,086,865 radio-graphic procedures. Comparison data from fiscal year 1993 shows TMC's outpatient visits and admissions are both declining; this in part according to the Department of Medicine is due to the rise in Telemedicine within the Pacific Basin (Roberson 1994).

In addition to its direct medical care mission, TMC maintains a strong Graduate Medical Education program with a medical internship, 11 residency and 4 fellowship programs, 5 graduate programs, and 2 nursing training programs. Concurrently, TMC operates as the Headquarters for one of the seven Health Service Support Areas for the Army Medical Command and is the lead agent for one of the twelve Department of Defense medical regions.

To support the medical, training and readiness missions, TMC has approximately 2,800 employees assigned; about 1,700 military and 1,100 civilian personnel. The staff includes over 400 physicians and 380 Registered Nurses. The annual operating budget is approximately $200 million (Lowe 1994).

Telemedicine Background At TMC

Telemedicine is defined as the practice of medicine where the patient and provider are separated by space so that connectivity between the two is provided by electronically supported medium. TMC's vision of telemedicine is the use of video telecommunications to extend the practice of medicine (Hastings 1994).

Healthcare Informatics--A leading publication for Healthcare Information Management recently polled the industry experts to identify "America's Most Computer Advanced Healthcare Facilities." Their findings ranked TMC in the top ten of all U.S. health care institutions in hospital automation in the United States. Making the "Runners-up" list was Naval Hospital Portsmouth and Eisenhower Army Medical Center (Lowe 1994).

This use of technology allows Tripler to serve as the prototype and test site for many new innovations in health care. The integration of Telemedicine as a component of this new technology has placed Tripler as number five in the United States in relation to the number of tele-video consultations performed since the program began in January, 1993 (Lowe 1994).

In January, 1993, Tripler established a link with the U.S. missile base on the island of Kwajalein, Republic of the Marshal Islands, located some 2,200 nautical miles southwest of Honolulu. To date, 185 tele-video consultations have been performed encompassing 18 medical specialties.

Kwajalein is supported by a 15 bed hospital, six physicians, and 70 other health care workers for a population of approximately 3,000 people. The majority of the

population are DoD contract employees and their dependents. In addition there are 30 Active Duty Army personnel. The Telemedicine program also sees Marshalese Nationals who live on the island of Ebeye located two miles from Kwajalein. The implementation of the program has averted 40 air evacuations saving approximately $85,000 in referral costs. (Delaplain 1994).

In January, 1994, Tripler organized the Pacific Consortium for Telemedicine. This organization is composed of representatives from DoD, and other Federal, State, and Non-profit, and private organizations interested in providing health care via Telemedicine to those who live in the Pacific. A working agreement is being developed with the Ministers of Health from several independent Pacific island nations to implement Telemedicine using the PEACESAT satellite communication network.

Tripler is also dedicated to providing quality medical care to all deployed forces in the Pacific. To do so, a variety of Telemedicine initiatives are being developed which use several communication technologies to ensure success of this mission. Such a telepresence will extend the medical expertise from Tripler Medical Center to deployed forces wherever needed. To date Tripler Telemedicine Clinic has successfully deployed a telepresence unit with the 25th Infantry Division (Light) for operations in the Joint Readiness Training Center, Fort Polk, Louisiana and implemented a pilot telepresence project onboard the United States Coast Guard Cutter Rush (Delaplain 1994).

Conditions That Prompted The Study

"Doing More With Less" is a trend that continues in the Military Health Care System. Faced with constant cutbacks and drawdowns, medical treatment facilities are forced to develop innovative solutions to provide care to its beneficiaries.

Combining telecommunications advances with medical care holds tremendous promise in the battle of rightsizing. Efficiencies of scale and resources not only save money but will improve diagnosis and treatment of ill patients throughout the military health system. Telemedicine provides an avenue of bringing specialty care to the battlefield, ship, or remote location to better serve the patient. This type of service will enhance the diagnosis and treatment, decrease medevac cost, and decrease lost man-hours.

As mentioned earlier, TMC's Telemedicine clinic has treated over 185 patients through the use of teleconsultations. The focus of this study is to determine the cost avoidance that telemedicine can provide an organization. During the literature review, numerous authors point out the benefits of telemedicine, but there appears to be a lack of information concerning cost. It is the intent of this research to provide some value concerning cost avoidance through telemedicine. In conjunction with my preceptor, Colonel Thomas Driskill, we determined that this would be a project not only of great value to the organization but could also be developed to fulfill the requirements of my Graduate Management Project.

Statement Of The Management Issue

To date, TMC is the leading force within the Military Health Care System in the use of telemedicine. TMC has reached a junction where the next step is to bring

telemedicine into the inpatient setting. The success of the outpatient teleconsultation with the Kwajalein Island and the pilot project with the Coast Guard has pushed TMC to the next level of care.

Currently, no assessment of cost benefit has been implemented into the Military Health Care System's Telemedicine Projects. The management issue is to evaluate these patients and determine if telemedicine is a viable solution to reduce or eliminate medevac flights. The literature strongly promotes the use of telemedicine as a tool for physicians to expand their scope of care; however the literature also points out the cost benefits of using the right tool.

This project was centered around patients who were medevaced into TMC as either an inpatient or outpatient. Through the Composite Health Care System (CHCS) and Retrospective Case Mix Analysis System (RCMAS) the data was sorted by medical specialty, patient status, and place of origin. The data provided the originating MTF and the amount of patients who accessed TMC through the medevac chain.

Literature Review

The Health Care Challenge

Although Americans spend more than $2 billion every day on health care, the challenges facing our health care system keep growing. Over 36 million Americans are faced with restricted access to health care because they lack medical insurance coverage. Policy-makers must find ways to contain spiraling health care costs, while at the same time making quality health care available to all Americans. Advanced telecommunications, provided over the existing, ubiquitous telephone network, offers American health care providers significant opportunities to reduce costs, expand access, and enhance the quality of services (Little 1992).

Telemedicine

Challenges To Implementation

It is ironic that despite dramatic advances in our ability to care for patients, our ability to translate that knowledge into an accessible, affordable health care system remains an elusive goal. As a result, millions of people have been unable to obtain even the most basic of health care needs (Allen 1994). Socio-economic and geographical barriers for patients, compounded by educational isolation for physicians, underline the problems. Providing a patient health care where and when it is needed with an assurance of quality and an economy of cost clearly must be the objective of any health care delivery system. Since the present system does not satisfy these criteria, alternatives are needed.

Telemedicine has been proposed as one of those alternatives. However, if telemedicine is to play a significant role, a number of implementation and operational issues will need to be addressed (Sanders 1994).

Applications

Telecommunications in medicine takes a number of different forms, but each case requires a method for producing an audiovisual signal at one site, converting that signal to a transmissible signal, transmitting, receiving the signal, and reconverting it to a usable format. In some cases, such as in some education programs, it is not necessary for the receiving site to be able to transmit both audio and video response; questions can be posed to a presenter via telephone. In many cases, especially with medical treatments, true two-way audiovisual linkage is essential. Signals are transmitted via analog or digital format using either satellite or, more recently, fiberoptic cable. One of the limiting factors to dissemination of telemedicine, until recently, has been the size and cost of the technology. Dramatic improvements in the past few years, along with improved transmission capabilities via satellite, fiberoptics and copper wire, have brought the technology much closer to practicality for many small medical centers and rural locations (Hudson 1992).

In the world of communication technology where the "state of the art" changes every six months telemedicine experts must determine what technology best suits their tele-presence needs. With all available technologies one must look at cost, quality, and access. The most commonly used modality of transmission for telemedicine practices

today is the Compressed Video Technology. Compressed Video is the method of choice because special networks such as dedicated leased lines or fiberoptics are not required for use. Compressed video utilizes commercial common-carrier telephone services available locally, nationally, and internationally. Compressed video provides the opportunity for virtually unlimited access throughout local sites, statewide facilities, or worldwide organizations. The system provides two way interactive audio and color video communication between two or more locations (Mahler 1992).

So how does all this work? Telemedicine's roots began with the most basic piece of equipment--the telephone. As time has passed we have refined the art of telemedicine but the backbone remains the telephone line. Just as in commercial television received in the home via cable or air wave, the same type of signal is utilized in Compressed Video systems. Just as Dr. Green spoke of in his class Information Management For Healthcare; all signals are broken down in sequences of ones and zeros (Green 1993). The Compressed Video system converts the signal to a digital signal (ones & zeros) that is manipulated by a computer processor and then forwarded or received within the telemedicine network (Mahler 1992).

The normal television signal requires up to 6 million Hertz per second or 90 million bits per second (Mbps) bandwidth. Compare these bandwidth requirements to the bandwidth required for a routine telephone call of 64 thousand bits per second (Kbps). Bandwidth is measured in cycles per second (Hertz) for analog transmissions or bits per second for digital transmissions. Generally, the higher the bandwidth utilized, the higher the transmission cost will be. The most common band of frequencies used for

communication (voice, data, and video) are six 64-Kbps channels yielding 384 Kbps bandwidth for most telemedicine programs. Telemedicine Networks may opt to use more or less bandwidth in their practice, but based on what bandwidth is utilized will determine the quality of transmission and cost of transmission (Mahler 1992).

The longest-running effective use of telemedicine appears to be in Australia and Canada, likely locations due to the large, sparsely populated land areas separating population centers. Early demonstration projects in Australia (Watson 1989) showed how effective satellite-based telemedicine could be. Similarly, Canadian groups effectively use telemedicine to provide both medical care and continuing medical education to remote sites (House Et Al 1987) Several projects in the U.S. also have shown some effective use of telemedicine.

Impediments to Care

The information explosion has surpassed the capabilities of our current regulated communications network. Limitations on the business opportunities of the telephone companies -- whether bans of long distance service, research, design and manufacturing, or interactive video services -- result in patients and healthcare professionals not having the full range of products and services that should be available to them. One of the most difficult hurdles to surmount is connectivity between local and long distance carriers. Recent legislation, The Local Exchange Infrastructure Modernization Act, aims to lift the local connectivity restriction and require local systems to have access to the more advanced fiber-optic and switching network (Spencer 1993).

Presently the current communications restrictions greatly reduce flexibility, responsiveness and creativity. A major barrier to the utilization of telemedicine is the current failure to reach the end user with information about its potential applications.

Technology - Design/Operation

Today any technology-based system needs to share the following characteristics: (1) adaptability to change; (2) ease of operation; and (3) minimal maintenance requirements. Changes in communication technology and information processing and management are occurring at a more rapid pace than even the most optimistic predictions. It is essential, therefore, that any multi-component telemedicine system have an open architecture and modular design that can adapt to upgrades with component replacement rather than system extinction. Technical expertise should be a prerequisite only for the integrator of the system not the people using it. System controls must be user-friendly and incorporated into a single control panel. Every effort should be made to convert the present configuration, in which a separate telemedicine consultative room is utilized, to a more flexible desktop multi-media platform that is accessible to the physician in his/her office (Sanders 1994).

Portability must also be a prerequisite to allow for the deployment of transportable telemedicine units that can service multiple remote facilities on an "as needed basis." System maintenance needs to be the simplest task of all - modularity of system components, telephone dial-up maintenance assessment algorithms, and "strategic" redundancy need to be incorporated into the system design. Most importantly, the design of the system must be dictated by the needs of the end-users not those of the system

architect. Functionality must control structure and the technology should have a transparent interface between users (Sanders 1994).

Operational personnel requirements are minimal. A single FTE at each site can manage system operation, scheduling of the consultations and preventative maintenance responsibilities. If the base station system is situated in proximity to the emergency department, telemedicine consultations can be made available to the remote rural hospital on a 24-hour per day basis.

Technological Compatibility

It is imperative that equipment manufacturers strive for competitive similarities rather than proprietary constructs. Systems that can't "speak" the same language will never integrate with each other, and, thus, will paralyze network development. Witness the minimal use of facsimile machines prior to the introduction of a common language and the explosion in sales when a common alphabet was introduced (Winter 1994).

Value/Economics

Telemedicine must be identified as a value added service to maintain its viability, and central to that objective, is that it be cost effective. Preliminary data from the Medical College of Georgia telemedicine system demonstrates that 81% of the patients who are seen over telemedicine have not required transfer to a secondary or tertiary care center. Given an average cost differential of $500 per day between the rural hospital bed ($800) and that at the Medical College of Georgia ($1300), even a 25% decrease in

transfers would be a significant cost savings. Add to that the savings in transportation costs, increased productivity, and the decreased hospitalization days resulting from treating a patient at an earlier stage in their disease process, it is apparent that the potential savings are significant (Sanders 1994).

Expanded use of telemedicne services has the potential to stabilize the economic situation of some financially troubled rural hospitals. The major problem for most rural hospitals is the loss of volume as more of the basic services are moved to the outpatient arena. In the more severe conditions the "rural patient" is forced to seek out the "high tech" medical centers in neighboring towns and cities. Through the use of telemedicine, the rural hospital has the potential to obtain immediate access to specialists thus increasing patient confidence in the care offered by their community hospital (Atkinson 1993).

In contrast to most new medical technology, telemedicine systems do not require major capital investments, and the cost of individual components continue to fall as the technology improves. Despite the relatively low cost, however, it is recommended that rural health care facilities, in order to conserve cash flow, lease the system over a three to five year time frame allowing the revenue generated by the anticipated increase in bed census and ambulatory activity to offset the leasing costs. (The leasing contract should provide for component upgrades so that the system always remains at the cutting edge.) Assuming that the average cost of a satellite site if purchased outright is about $160,000 it should be noted that an increase of a single patient to the average per day bed census represents a net cash flow of $150,000/year to the hospital. However, despite the reduced capital expenditure many rural hospitals will still not have the needed start-up funding.

If that is the case, then it is recommended that government (local, state and/or federal) provide a loan to "pump prime" these facilities. As revenue is generated the rural hospital will then be able to assume the monthly leasing costs as well as payback the start-up loan (Sanders 1994).

Educational Value

Perhaps one of the most important applications of telemedicine that will significantly foster its implementation is its capacity to alter the state of professional isolation that now exists for the rural based physician. Telemedicine addresses each of the necessary characteristics of an effective CME experience namely that the information provided is (1) timely, (2) pertinent to the issue, (3) convenient to obtain, (4) repetitive, and (5) up-to-date. By providing immediate access to colleagues at the medical center, telemedicine creates an "electronic umbilical cord" between the two facilities, and allows for a real-time interactive educational experience for the referring physician. As importantly, it helps the academic based consultant to be more aware of, and sensitive to, the needs of the rural-based physician. An added fringe benefit is that, depending on the nature, format and comprehensives of the consultative interchange, it is possible to grant category I CME credits to the rural-based physician (Lindsay Et Al 1987).

The significance of obtaining these credits is underlined by the fact that in many states re-licensure is dependent on having accumulated these credits and without this on-site opportunity afforded by telemedicine the process is both inconvenient and expensive.

Communication Costs

Telemedicine systems can interface with a variety of communication modalities (copper wire telephone lines, fiberoptic cable, microwave and satellite) thereby providing maximum flexibility for interconnectivity between sites. One problem with the use of telephone lines, however, is the complex rate structure that exists between LANs that create unrealistic communication costs. Although the introduction of ATM switching and fiberoptic cable will dramatically reduce per use cost, until those technologies are more generally available lower transmission costs for telemedicine will need to be structured to make it economically feasible for rural hospitals to participate (Mahler 1993).

Motivation for Providers and Patients

It is clear that a number of factors need to be in operation for both physician and patients to use the system, but, perhaps the most fundamental, is for the "users" to recognize a simple paradigm shift. One of the interesting aspects of telemedicine is the perception on the part of both physician and patient that this technology is futuristic. In fact, it incorporates all "off-the-shelf" technology. The telecommunications, cameras, remote control optics, and examination devices are utilized on a day-to-day basis by each of us simply in different settings. With the same technology that allows us to watch a news anchor interact in real time with his/her correspondent in a distant part of the globe, or view through the use of a telephoto close-up lens, a distant landscape in intimate detail, so too can we examine a patient at a remote site.

For the rural based physician other operational motivating issues require that: (1) the time involved in a telemedicine consultation must integrate into his/her daily schedule and, if the physician can not participate in the consultation, a nurse at the remote end would suffice to allow for an effective examination by the consulting physician; (2) the consultation be reimbursable; (3) the consultation not be competitive; (4) continuity of care, by avoiding unnecessary referrals to secondary or tertiary care centers, be increased; (5) the physician's revenue stream be enhanced; (6) the consultation functions as an effective educational experience; (7) the system be easy to use; and (8) most importantly, it be perceived by that physician's patient as an effective consultative exchange (Allen 1992).

Many of the critical factors outlined for the rural based physician hold true for the consulting physician. Economy of time, ease of use, and a method for reimbursement are obvious needs. Perhaps the most difficult hurdle that telemedicine needs to clear is to satisfy the technical requirements of the consulting physician. To achieve this it is important that the system architect understands those needs prior to designing the system. Resolution capabilities are critical for the radiologist/pathologist; technological simplicity and user friendliness characterize the need of the mental health care professional; and audio quality of the electronic stethoscope and real time transmission of echocardiograms identify the desire of the cardiologist. Experience from previous telemedicine initiatives have taught us to anticipate that each specialist will come with a different expectation of the systems capability. This needs to be addressed and understood by those who endorse the introduction of telemedicine into the healthcare delivery system (Tangalos 1993).

The ultimate test of the value of telemedicine will be dependent on how the patient perceives and adapts to it. If the patient feels the technology makes the consultation too impersonal; if the telemedicine consultation costs more and is not covered by insurance; and if the patient wants to have the physician literally at their side, telemedicine will not be an acceptable delivery system (Allen 1992). In the same manner that there is a learning curve for the physician, we can anticipate a similar situation for the patient. A system that is designed to allow direct eye-to-eye contact, that is easy to use, and that gives the patient the ability to control the interview camera has been shown in previous telemedicine systems to be very "patient friendly." In fact, the patient has perceived himself or herself as being treated in a very special way. In the final analysis it will be the human component at each end of the system -- not the technology -- that will determine whether it is successful or not. Once again the design of the system must be determined by the needs of the people who use it.

Other Uses

It should be recognized that the telecommunication link between sites can be used for multiple purposes, including administrative meetings, nursing and other allied health educational or direct patient care activities. Telemedicine sites could also be integrated into a state's distance learning initiative so that preventative health care programs as well as acute episodic care intervention can be introduced to the classroom.

Continuous Quality Improvement - CQI

As with any component of the health care system, new or old, there must be regular oversight evaluation to ensure that the objectives for which it was introduced are continuing to be met. Economic viability, quality care, accessible service, appropriate utilization and educational strengths will need to be regularly verified in order to justify the continued operational status of the system.

Implementation

A major barrier to the utilization of telemedicine is the current failure to reach the end user with information about its potential applications. Technology vendors, healthcare administrators, state health administrators, and subspecialty physicians in regional medical centers are not the end users. The family practitioner or public health nurse in the under-served area are the people to who need to learn more about telemedicine and begin to guide its development.

The implications telemedicine has to the health care reform debate are significant. In general, the conceptual framework we use in this debate is a fee for service environment. If the Administration's Health Security Act of 1993 is successful at providing basic coverage and access to all Americans, then telemedicine can be a part of the solution. The paradigm will also take us more closely to a managed care environment where the solutions to problems of access and delivery reside with accountable plans more likely to embrace new technologies for the delivery of services (Sanders 1994).

Practitioners and patients in isolation may ultimately determine the usefulness and implementation of telemedicine. Given the expense involved to establish new networks of

care, the measure of success may be based on community standards rather than usual and customary medical practice. Capital outlays may force relaxed services including educational and administrative functions to run in parallel with patient care. Health care reform may allow calculations for travel and lost time to be included in a more global understanding of budget and costs.

Barriers To Telemedicine

As a patient the barriers to health care are cost, access, and quality. For health care providers and executives the barriers take on different names: they are licensure, credentialing, liability, confidentiality, accurate recordkeeping, reimbursement, and a uniform practice for the standards of care.

The hottest debate in the telemedicine field is one of licensure. It is anticipated that, based on the present individual state licensure system, a physician utilizing telemedicine to provide consultative services to a patient would have to be licensed in every state that the patient resided. Given the often burdensome process involved in obtaining state licensure it is unlikely that many physicians will pursue that avenue and, thus, potentially significantly limit the networking capability that this telecommunication system affords (Tangalos 1993).

During a session of the Kansas state legislators, a law was passed that required out-of-state physicians who provide telemedical consultations to be licensed by the state to which the patient resides. This new law has revived the ongoing debate over telemedicine issues such as licensure, credentialing, and liability. According to Dr. Jay Sanders, director of the Telemedicine Unit at the Medical College of Georgia, "if these bureaucratic

hassles continue in obtaining multiple licenses it could limit the practice of telemedicine" (Sanders 1994).

A number of potential solutions are proposed. First, individual state licensure for telemedicine should be converted to a national licensure similar to the military health care system. In fact, since physicians are required to take national examinations for licensure and certification it seems illogical to have a system of individual state licensure in the first place. Perhaps, in order to assess the impact of such a change, a "national" license could be provided to those physicians who provide telemedicine consultations to patient populations that have been defined a "under-served". Second, in the instance of a specialty consultation requested by the primary care physician the referring physician retains responsibility for the care of that patient. Therefore any "care" provided over telemedicine by the consulting physician in another state could be viewed as recommendations only. Lastly, perhaps the most logical way to deal with state licensure requirements is to determine that the patient is, in fact, being "electronically transported" to the physician rather than the physician being transported to the patient. Physicians who treat out-of-state travelers/patients who cross state lines to receive their care are not required to have multiple licenses--telemedicine practitioners should be granted the same leeway (Sanders 1994).

Credentialing

Although issues similar to the licensing debate can be raised with reference to credentialing, it would appear that an opinion provided by the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) for the Medical College of Georgia

(MCG) telemedicine system could be uniformly applicable. The JCAHO determined that a physician at MCG who provided a telemedicine consultation of a patient at Dodge County Hospital (a rural hospital 130 miles distant from MCG) would not have to be credentialed at that rural hospital as long as any orders written in the patient's chart were by the referring physician at Dodge County Hospital. The consulting physician is not considered the physician responsible for the care of the patient (Dakins Et Al 1994).

Liability/Malpractice

Concerns over malpractice liability may prove to be one of the most troublesome problems and could impede the general application of telemedicine. Obviously, any analysis of "what might be" will only gain validity from the outcome of precedent setting cases. Although, we have no evidence of any malpractice activity having been generated by past and present telemedicine initiatives, one can anticipate that as reimbursement becomes a reality and as medical centers with "deep pockets" who become networked with remote sites are viewed in an "agency" relationship, more attention will be paid to this area by the legal profession. It also should be recognized that those telemedicine systems that utilize digital compression technology to transmit images will have a very special type of liability exposure, namely, that the "data" being reviewed by the consulting physician is not complete. The inability, at present, for telemedicine systems to allow for actual "hands on" examination of the patient will serve to foster the perception that a telemedicine consultation is incomplete or inadequate. This perception has forced many facilities to expand their telemedicine staff with an attorney to fully research the legal ramification of telemedicine services (Sanders 1994).

Clearly, a preventative approach to liability is the best defense. It must be stressed to the physician that if the visual/audio links do not provide adequate information transfer to allow for appropriate diagnostic interpretation none should be made. Videotaping of the entire consultative exchange will provide excellent record keeping and avoid the common pitfall of lack of documentation. Telemedicine systems that provide access to up-to-date references as well as the expanding library of "practice guidelines" now being introduced by the specialty societies will help to address the issue of whether the care provided by the physician satisfied community standards. Perhaps the doctrine of "sovereign immunity" could be applied to those physicians/medical centers that offer telemedicine consultations to the under-served (Sanders 1994).

Confidentiality

The transmission of personal and sensitive medical information over communication lines clearly lends itself to electronic intrusion and exposure. Encrypting algorithms will need to be introduced, but it is naive to think that even the most sophisticated code could not be broken. Once again legal precedent will determine the standard, but it is likely that if "reasonable and customary" efforts are taken to maintain the security of records this issue will not be difficult to resolve. In fact, if one examines the fairly open access to patient records that prevails in our existing system it can be expected that the electronic transfer of medical information may have more security (Tangalos 1994).

Recordkeeping

Telemedicine/"Electronic House Calls" will not ease the burden of recordkeeping--it will only sophisticate the system. Videotaping will allow for more accurate, as well as, expanded capture of medical information. However, medical records will exist at both ends of the communication link, thus raising the question as to which record reflects the legal one. How are we going to "edit" the vast amount of information retrieved and will deletion of "unimportant" components of the patient's history and physical examination be considered record tampering (Tangalos 1994)?

Reimbursement

An underlying issue that must be addressed before telemedicine can be fully utilized is reimbursement for the medical care which involves advanced communication networks. Currently, only technology-based information transfer (e.g. - reading of transmitted radiological images) is routinely reimbursed by federally-funded health care programs such as Medicare. Many questions must be addressed before this coverage will be offered by regional carriers and third party payers. For example, can the usual requirement for "face-to-face" contact between physician and patient be modified? Is the quality of care provided via telemedicine up to standards of the medical community (Tangalos 1994)?

The Health Care Financing Administration rightfully asks for outcome studies as it plans its strategy to pay for services but may hold telemedicine to greater scrutiny than what currently defines the daily practice of medicine. There is great hesitancy on the part

of many providers to enter the practice of telemedicine given the uncertainty of how these services are to be recognized and reimbursed (Tangalos 1994).

It is essential that active telemedicine programs begin to collect data in a standardized fashion so that larger volumes of information can be gathered in a systematic way to guide best practice models. Programs like those at the University of Kansas have begun to look at changes in practice patterns and outcomes of care. Although these projects have very small numbers, this type of activity will provide the credibility to substantiate telemedicine as a new paradigm to deliver medical care (Tangalos 1994).

Unfortunately, the literature is devoid of outcome studies or health care effectiveness research. Given the lengthy adolescence of telemedicine, most published accounts on direct physician to patient interactions are descriptive or at best evaluative. None of the projects have gone into great detail to use the framework of Structure, Process and Outcome. In today's vernacular of health care reform the terms would be Access, Quality and Cost, but the rigors for scientific investigation should be the same. Specific aims need to be established for investigators to use appropriate materials and methods to measure and evaluate results. Conflicts are sure to arise if policy and practice rush ahead of cost effectiveness and practical economics (Tangalos 1994).

Standards of Care

Acceptable standards for telemedicine activities may include the provision that less information will be available to provide care than face-to-face in-person consultation. Thus, effectiveness research is needed to evaluate patient satisfaction and functional status. Utility measurements will need to focus on outcome rather than

process. Clinical trials will need to be considered on their own merit but also in the larger context of telemedicines value to the community (Tangalos 1994).

The institution of guidelines for the application of telemedicine is being quickly realized. As telemedicine appears to be on the verge of making the transition from an experimental and research technology to an applied silence, there may be tremendous practical application. The medical community through its professional societies as well as governmental agencies such as the Agency for Health Care Policy and Research Office of the Forum and the Health Care Financing Administration's Health Standards and Quality Bureau will be interested in best practice models (Tangalos 1994).

However, a number of universal problems will be confronted when approaching telemedicine across state lines. The first two issues are matters on which Congress might wish to consider developing some standardization. The last four items are matters which more appropriately should evolve through the practice of telemedicine (Tangalos 1994).

1. Defining situations in which licensing is required;

2. Assuring compliance with licensing requirements when applicable;

3. Determining an acceptable interface for patients from separate groups or private practices that have purchased dissimilar equipment;

4. Establishing criteria to engage physicians in the consultative practice of telemedicine both within an institution and in the community;

5. Insuring appropriate billing mechanisms and third-party reimbursement for telemedicine consultations;

6. Defining the practice parameters between providing consultative services and actual participation in a patient's care.

Health Care And Financing Administration

The agency that foots the bill on healthcare is concerned that no clinical studies are yet available to show that telemedicine treatment is as safe and effective as face to face treatment by the physician. They are so concerned that they have issued a grant to the University Of Colorado's Center For Health Policy Research to study the effectiveness, acceptance, confidentiality, and malpractice issues involved with telemedicine (Parsons 1994).

To date the only telemedicine center to receive approval for Medicare and Medicaid reimbursements for telemedicine consultations is the Medical College of Georgia. The Georgia Center links 2 rural hospitals, a public health clinic, and prison facilities. Outpatient/Ambulatory care centers are in the process of being added to the network. According to HCFA no national policy for reimbursement of telemedicine exists, but regional offices (carriers) are free to make their own decisions concerning reimbursement for telemedicine practice. The carrier in Georgia that has boldly gone where no carrier has gone before is Aetna Life and Casualty (Parsons 1994).

Summary

I have attempted to paint a picture of some of the issues related to the implementation of telemedicine. Whatever new directions or programs we eventually initiate to improve access and care, they must be coupled with a commitment to analyze and critique them. The partnerships to make telemedicine work include the patient, the health care team, private/public carriers, and a supportive political and regulatory community.

Despite the feeling that changes need to be made rapidly, solutions cannot come overnight. Tripler is the beginning of what a complete DoD health care system can be. Resources are already in place and the program is leading by example through joint projects with the U.S. Coast Guard and the Kwajalein Islands.

Tradition has maintained the old paradigm that if the service member is sick, injured, or needs a specialist we just pack them up and send for a medevac. Costing the organization thousands of dollars in medevac expense, lost man-hours, and unit productivity. The new way of thinking is to bring the specialist to the patient through the electronic pathway. New programs, must be developed to provide the flexibility to accommodate to a wide variety, of practice situations and a built-in mechanism to respond to changes in program objectives. The true measure of the performance of any new system will be its cost effectineness in improving the health of the people it serves.

Purpose Statement

The purpose of this project is to determine the amount of cost avoidance by implementing telemedicine as a tool within the Pacific Basin. Cost avoidance is defined as savings through reduction/elimination of medevac flights, decreased patient hospitalization, and decrease in lost man-hours.

Objectives

The overall objective of this project is to provide information based on scientific research that will aide Tripler Medical Center and the Military Health Care System to reduce cost through the use of telemedicine. Through the Composite Health Care System

(CHCS) and the Retrospective Case Mix Analysis System (RCMAS) we are able to identify and sort patients by location, status, ICD-9 Code, and medical specialty. Patient location will be defined as place of origin, status will be inpatient or outpatient, ICD-9 Code will be the numeric code which identifies inpatient diagnosis, and medical specialty will identify the medical service assigned to the outpatient consultation.

The following is a list of specific objectives that the project will focus on:

- Identify high volume MTF's within the Pacific Basin who medevac patients.
- Identify the medical specialties of the medevac patients.
- Identify the MTF's medevac patients for a12 month period by origin & medical specialty.
- Provide a baseline on potential cost avoidance per year for future assessments.
- Report findings to TMC's leadership to assist in developing effective and cost saving strategies to optimize the Military Health Care System in the use of telemedicine.

Chapter II

Methods And Procedures

A quantitative and analytical methodology was used in evaluating the cost avoidance of telemedicine. The primary instrument in data collection was a retrospective study of medevac patients for Fiscal Year 1993. Data was be captured via the CHCS & RCMAS systems.

The data was collected and sorted to represent the seven MTF sites: 1) 0612--Army 121 Evac, 2) 0620--Navy Guam, 3) 0621--Navy Okinawa, 4) 0622--Navy Yokosuka, 5) 0640--Air Force Yokota, 6) 0639--Air Force Misawa, and 7) 0998--Navy Ships (Table 1).

Table 1---Patients Per MTF--Per Specialty

	Navy Guam	FPO Ships	Air Force Misawa	Navy Okinawa	Air Force Yakota	Army 121 Evac	Navy Yokosuka	Total
HEM/OC	199	0	84	131	119	19	24	576
PEDS	28	46	120	31	6	18	65	314
CARD	72	35	21	34	52	32	7	253
OB/GYN	24	71	23	13	29	1	31	192
OPTHL	23	84	0	14	0	13	3	137
ORTHO	88	34	3	0	5	12	9	151
DERM	8	99	1	6	0	1	2	117
GAST	1	15	4	24	18	15	0	77
PSY	2	46	0	0	17	3	3	71
UROL	19	8	12	7	3	6	1	56
NEPH	17	7	0	0	0	25	5	54
NEURO	13	12	16	0	4	3	2	50
INT MED	8	22	6	0	4	4	0	44
INF DIS	19	2	0	1	3	8	0	33
RHEUM	8	3	3	4	5	8	0	31
TOTAL	529	484	293	265	265	168	152	2,156

This leads to one of the flaws found with the current CHCS system--presently there is no mechanism in place to count patients verse number of clinic visits. Thus, after reviewing with the clinics and sorting patients by first time referrals verse return visits the patient count was 2,156. This total reflects a closer account of true medevac patients passed throughout the Pacific Basin. According to TMC's Medevac Office, the annual air-evacs range between 2,000 and 2,500 patients. This leads us to the second flaw within the current medevac system--no true record keeping.

Medevac records are not automated and filed--they use the "stubby" pencil method and files are destroyed yearly. This type of system hinders decision making when management reviews historical data to evaluate the "process" because their is no prior data. This point was brought out and reported up the chain of command.

After the sort per MTF site, the data was sorted to represent the medical specialties and number of clinic encounters. Using the present day medical specialties available from TMC's telemedicine clinic, the data was sorted to reflect what specialties could be supported. These specialties include: Psychiatry, Dermatology, Neurology, Rheumatology, Cardiology, Gastroenterology, Urology, Nephrology, Optometry, OB/GYN, Pediatrics, Orthopedics, Internal Medicine, HEM/ONC, and Infectious Disease. With the data sorted and matched to medical specialty it was then presented to the Delphi panel for review and evaluation.

The Delphi Study

The Delphi technique was first developed as a forecasting tool at the RAND Corporation. Dr. Ollaf Helmer, a mathematician--philosopher and one of the founders of the Institute for the Future, developed the technique as an attempt to deal with very distant futures by making systematic use of the "intuitive guesstimate" of large numbers of experts (Lindeman 1981).

The RAND Corporation continued to refine the Delphi procedure, and around 1950 the technique was used on problems of group information utilization. It has gained considerable recognition and is used in planning settings to achieve a number of objectives: 1) Determine/Develop a range of possible program alternatives, 2) Explore/Expose underlying assumptions or information leading to different judgments, 3) Seek out information which may generate a consensus on the part of the respondent group, 4) Correlate informed judgments on a topic spanning a wide range of disciplines, and 5) Educate the respondent group as to the diverse and interrelated aspects of the topic (Delbecq Et Al 1975).

The Delphi technique is a systematic, iterative method of forecasting based on independent inputs from a group of experts. Its objective is to obtain a consensus of opinion from a panel of experts regarding future events. In practice, forecasts or estimates of long-term future scenarios may be derived by using numerous methods, including intuitive forecasts, trend extrapolation, trend correlation analysis, and analogy techniques (Arthur Andersen & Co. 1984).

As mentioned, the Delphi Technique is a method used to establish priorities and predict future trends. In the Summer 1993 issue of Hospital & Health Services Administration--the article titled *Health Care Administration in the year 2000* demonstrated this concept by identifying a group of experts in the field of Health Care Administration in an effort to prioritize and predict the needs of the future health care executives. (Hudak Et Al 1993).

The Delphi Technique has been applied to numerous fields since its development in the 1950's. In the past few years, there have been many applications of the technique in such areas as industry, social/health planning at the community level, evaluation of research projects, and educational innovations. One of the most extensive uses of the method has been in higher learning. In education and healthcare the focus has been cost-effectiveness, cost/benefit analysis, organizational goals & objectives, and consensus rating scales and values (Lindeman 1981).

As the literature points out, the Delphi Technique has been used for nearly 50 years in fields ranging from industry, community planning, education, and healthcare. Due to its long history of use and success the process is widely accepted for accuracy, reliability, and validity. The technique can be used in most any type of decision making process; from the most complicated survey to the simplest interview. We use a form of the Delphi Technique in our everyday lives; whether it's buying a car, computer, house, or even groceries we seek out who we think are the area experts.

In this study, using CHCS, data was gathered on patients residing outside TMC's catchment area to determine the medical specialty code and originating MTF.

The group of experts used in this study included physicians, clinicians, nurses, and administrators working within the telemedicine arena. Service chiefs who's medical background matches the medical specialty of the medevac patient provided valuable insight to the feasibility of the practice of Telemedicine.

Within DoD the field of Telemedicine is in it's infancy stage--there are no "True Telemedicine Experts". The literature points out three dominate experts in the field of telemedicine, there are: 1) Dr. Ace Allen, University Of Kansas, 2) Dr. Eric Tangalos, Mayo Clinic, and 3) Dr. Jay Sanders, Medical School Of Georgia.

Research Plan

The Graduate Management Project Proposal was briefed to the Commanding Officer and the Chief of Staff of Tripler Medical Center. After a few recommendations there was unanimous consensus on this projects need and utility. The next step was to develop a conceptual framework for the Graduate Management Project.

Working very closely with TMC's Telemedicine Clinic and Coordinated Care Office a conceptual framework was designed to meet the needs of the project by collecting data retrospectively using CHCS and RCMAS. After collection, the data was coded, analyzed and reviewed via the Delphi technique with the results and recommendations presented to TMC's Commanding Officer.

Data Collection

Data collection was gathered retrospectively using CHCS and RCMAS for Fiscal Year 1993 from the following MTF sites: 1) Naval Hospital Guam, 2) Naval Hospital Okinawa, 3) Naval Hospital Yokosuka, 4) 121 Evacuation Hospital Korea, 5) 432 Medical Group Misawa Japan, 6) 374 Medical Group Yokota Japan, 7) Ship FPO's.

Data collection included patient type, medical specialty, origin of patient, medical specialties available at MTF, and bed size of MTF (Table 2).

Table 2-------------------------Medical Specialties Per MTF With Bed Capability

	Army 121-Evac	Navy Yokosuka	Navy Okinawa	Navy Guam	Air Force Yakota	Air Force Misawa	FPO Ships
# Beds	207	145	104	55	25	20	N/A
Psych	Y	Y	Y	Y	Y	N	N
Derm	Y	N	Y	N	Y	N	N
Neuro	N	N	N	N	N	N	N
Rheum	N	Y	N	N	Y	N	N
Card	Y	N	N	N	Y	N	N
Gast	Y	Y	Y	Y	N	N	N
Urol	N	N	Y	N	N	N	N
Nephr	Y	Y	Y	Y	Y	Y	N
Opthl	Y	Y	Y	Y	Y	Y	N
Ob-Gyn	Y	Y	Y	Y	Y	Y	N
Ped's	Y	Y	Y	Y	Y	N	N
Ortho	Y	Y	Y	Y	Y	Y	N
Int Med	Y	Y	Y	Y	Y	Y	N
Hem/Oc	N	N	N	N	N	N	N
Inf Dis	N	N	N	N	N	N	N

In addition to the medevac patients from the MTF sites a review of the teleconsultations from Kwajalein Clinic was done. Working with TMC's Telemedicine Clinic research on the following issues was done:

- Over a one year period how many medevacs were done prior to the placement of the telemedicine clinic.
- Annually, how much money was being on healthcare prior to telemedicine,
- After the placement of the telemedicine clinic how many medevacs were done over a one year period.
- What was the annual cost for medevacs during that year with telemedicine.
- How is telepresence accepted by the patient and provider.
- Have these teleconsultations reduced inpatient hospitalizations.
- Have these teleconsultations reduced medevac flights.

Target Population

As mention earlier in the description of TMC there is an estimated referral population of 579,392. This estimate is further divided into United States Pacific Command military and dependents, Department of Veterans Affairs beneficiaries, and qualified Pacific Island Trust Territory beneficiaries. This population is of the size where a stratified random sample can be obtained. A stratified methodology ensures that a representative sample of the differing subgroups are measured. These subgroups include the various medical specialties found within the Military Health Care System (MHCS). For the purposes of this study the target population is limited to the medevac patient originating from the seven defined MTF's.

Ethical Considerations

To ensure patient confidentiality no names, social security numbers, or any identifying information was accessed; however, specific demographic data was used.

Chapter III

Findings And Utility Of The Study

The findings from this project identified certain medical specialties within the Pacific Basin which could benefit from telemedicine. The benefits are limitless--from medical education to reduction in CHAMPUS costs. Through guidelines/protocols Pacific Basin MTF's can establish a telemedicine network which provides medical education and reduces needless medevacs saving countless thousands of dollars and man-hours.

The utility of this project can spread throughout the MHCS. By using telemedicine as a tool to provide more efficient health care local MTF's enhance their patient care while MTF's such as Tripler strengthens the medical community throughout DoD.

Medical technology, specifically the communications aspect has experienced phenomenal growth throughout the past decade. The Information Highway continues to grow and move at speeds which are immeasurable--Telemedicine is on that highway. It is still unclear on the exact cost of telemedicine, but through research and continued studies the benefits outweigh the expense. The literature points the widespread use of telemedicine throughout the world and we as an organization, must shift the paradigm of medical care to embrace the use of telemedicine as a method of health care delivery (Rayman 1992).

Through telemedicine an MTF can expand their scope of practice to offer the most isolated provider the state of the art care/specialist. This project will established a cost avoidance baseline and possible savings through the benefits of telemedicine. This project

will identify medical specialties that may most benefit from telemedicine, thus reducing costs and lost manpower for that organization. From these findings a foundation can be established to assist the organization in further research into telemedicine.

Findings

The Medevac System

TMC is the lone DoD tertiary care facility serving the Pacific Basin. TMC serves as the "hub" for care throughout the Pacific with "spokes" as far away as Alaska and Japan. Every month TMC's Air-evac Branch manages 8 incoming flights and 2 outgoing flights with approximately 250 patients within the medevac chain. The routine medevac originates out of Yakota Air Force Base, Japan and arrives at TMC every Wednesday and Saturday bringing patients from all over the Pacific Basin. Medevac patients from Guam, Okinawa, Korea, Japan, and Ships at sea must remain over night (RON) in Yakota the night prior to the scheduled medevac. The return medevac flight departs TMC every other Wednesday; arriving back in Yakota where return patients must RON until morning where at such time they are returned to their respective units.

As one can see this is a very time and labor intensive procedure for both the medevac patient and staff. The calculations in this study are based on a ten day period but it is not uncommon to have patients in the system for weeks at a time. Due to the health care "environment" and the time and distance involved within the Pacific Medevac System, 33 percent of all medevac patients travel with a medical/non-medical attendant.

The cost factors for medevac patients are numerous; flying medevac round trip from Yakota, Japan to Honolulu, HI. is $788, pier diem for the Honolulu area is $105 for

lodging and $62 for meals per day ($167 total), lost manpower to parent command equates to service members daily norm--an average daily norm for an O-3 military pay-grade level is $135, the average for an E-6 is $110 per day. An additional travel cost of $788 will occur per every third medevac patient due to the accompaniment of the medical/non-medical attendant. The average cost for an active duty member ranges from $3,808 for an O-3 to $3,558 for an E-6. All costs are based on an average length of stay within the medevac chain of ten days.

Patient costs are incidental to the cost of the aircraft and crew. The C-141 medevac flight flies at a cost of $3,500 per hour and the C-9 Nightingale flies at a cost of $2,600 per hour. The C-141 aircraft is the carrier between Yakota, Japan and Honolulu, Hawaii with the C-9 Nightingale used as shuttle between Yakota and Guam, Korea, and Okinawa. The average flight times between all destinations are: Yakota to Hawaii--8 hours, Yakota to Guam--3.3 hours, Yakota to Okinawa--2.5 hours, and Yakota to Korea--2.25 hours.

The "Center" for all medevac patients traveling within the Pacific Basin is located at Yakota Air Base, Japan. Yakota is the hub for all patients traveling to Japan, Korea, Okinawa, Guam, Hawaii, and the continental United States. This medevac hub transports approximately 10,000 patients and medical attendants annually. During this study the medevac system transported approximately 2,156 patients and 718 medical/non-medical attendants to Tripler Medical Center for outpatient treatment (Table 3).

Table 3----------------------Comparison Data Per MTF--Per Specialty--%MD Vs %Ship

	Navy Guam	FPO Ships	Air Force Misawa	Navy Okinawa	Air Force Yakota	Army 121 Evac	Navy Yokosuka	Total
HEM/OC	199	0	84	131	119	19	24	576
PEDS	28	46	120	31	6	18	65	314
CARD	72	35	21	34	52	32	7	253
OB/GYN	24	71	23	13	29	1	31	192
ORTHO	88	34	3	0	5	12	9	151
OPTHL	23	84	0	14	0	13	3	137
DERM	8	99	1	6	0	1	2	117
GAST	1	15	4	24	18	15	0	77
PSY	2	46	0	0	17	3	3	71
UROL	19	8	12	7	3	6	1	56
NEPH	17	7	0	0	0	25	5	54
NEURO	13	12	16	0	4	3	2	50
INT MED	8	22	6	0	4	4	0	44
INF DIS	19	2	0	1	3	8	0	33
RHEUM	8	3	3	4	5	8	0	31
TOTAL	529	484	293	265	265	168	152	2,156

	% Medevac Ship	% Medevac MTF/MD	% Total
HEM/OC	0%	100%	27%
PEDS	15%	85%	15%
CARD	14%	86%	12%
OB/GYN	37%	63%	9%
ORTHO	23%	77%	7%
OPTHL	61%	39%	6%
GAST	19%	81%	4%
UROL	14%	86%	3%
NEPH	13%	87%	3%
PSY	65%	35%	3%
INT MED	50%	50%	2%
INF DIS	6%	94%	2%
NEURO	24%	76%	2%
RHEUM	10%	90%	1%
TOTAL	22%	78%	100%

The Delphi Technique

As stated earlier, the Delphi Technique is a method used to establish priorities and predict future trends. The panel of experts were interviewed for their ideas, opinions, and medical expertise concerning the use of Telepresence within the Pacific Basin. All experts were board certified in their specialty and comprised more than 225 years of medical practice. Based on individual interviews the specialists were grouped in categories of: Believer, User, and Consultant. They were ranked as: Very Strong, Strong, Moderate, Little to None, and Uncertain. A comment line was provided for their individual thoughts and opinions. A break down of the findings are as follows:

Psychiatry:
Believer: Strong
User: Moderate
Consultant: Moderate
Comment: Psychiatry is where Telemedicine got its start as a means of practice--early group therapy sessions, 1959. Presently, the field of Psychiatry is one of the few areas of medicine where "High-Tech" equipment is not required. Coupled with a Computer/MTV society Telemedicine is a valued method of practice.

Dermatology:
Believer: Very Strong
User: Heavy
Consultant: Heavy
Comment: Tripler's most pioneering department in the use of telemedicine--Continues to test and develop different imagining devices to better care for DoD beneficiaries. Instrumental in treating casualties and saving medevac dollars during the Joint Task Force Operation from FT Polk, Louisiana. Presently working with the Public Health Service in implementing a working network between Tripler and the Pacific Islands.

Neurology:
Believer: Uncertain
User: Little to None
Consultant: Little to None
Comment: Telemedicine could be used as a method to screen potential patients, but due to medical specialty and the liability question--this service requires physical presence of patient & physician.

Rheumatology:

Believer: Strong
User: Little to Moderate
Consultant: Little to Moderate
Comment: Telemedicine is a useful tool--More marketing of the benefits should be provided to staff members--wants to be more involved.

Cardiology:

Believer: Uncertain
User: Moderate
Consultant: Moderate to Heavy
Comment: Presently, the FAX & Telephone are the best tools for the practice of Telemedicine. It could be used in certain fields as a screener, but this service still requires physical presence of patient & physician

Gastroenterology:

Believer: Uncertain
User: Little to None
Consultant: Little to None
Comment: Our Medical specialty is too complex--Telepresence is not a feasible method of practice.

Urology:

Believer: Uncertain
User: Little to None
Consultant: Little to None
Comment: Our Medical Specialty is too complex--Telepresence is not a feasible method of practice.

Nephrology:

Believer: Very Strong
User: Moderate
Consultant: Moderate
Comment: A strong and growing tool within the medical field--could reduce up to one third of outpatient appointments. Wants to be more involved.

Ophthalmology:

Believer: Strong
User: Moderate
Consultant: Moderate
Comment: Presently working on a research project that will assist the battle field physician using a means of Telemedicine to assist in the treatment of eye injuries. Wants to become more involved.

OB/GYN:

Believer: Very Strong
User: Little to None
Consultant: Moderate
Comment: A viable tool--wants to be more involved. Could decrease 75 to 90 percent of medevac outpatients. A better focus is needed within the command--more marketing of Telemedicine benefits to staff providers.

Pediatrics:

Believer: Strong
User: Little to Moderate
Consultant: Moderate
Comment: The next generation of medicine--viable tool within the practice of medicine. Could reduce medevac outpatients by 50 percent.

Orthopedics:

Believer: Very Strong
User: Moderate
Consultant: Moderate
Comment: Could reduce all non-surgical medevac outpatients. Great tool to use as an educator for GMO/Non-specialist provider. A need for a marketing plan and a define focus for the staff members.

Internal Medicine:

Believer: Uncertain
User: Little to None
Consultant: Little to Moderate
Comment: Used as a screener/educator for organizations without specialist--Ideal for Ship board or field units.

Hematology/Oncology:

Believer: Uncertain
User: Little to None
Consultant: Little to None
Comment: Medical specialty too complex--Patients too sick. Telepresence is not a feasible method of treatment.

Infectious Disease:

Believer: Uncertain
User: Little to None
Consultant: Little to None
Comment: Medical specialty too complex--Patients too sick. Telepresence is not a feasible method of treatment.

There is overwhelming consensus that Telemedicine is a viable tool for the practice of medicine. A major concern noted from the panel was a lack of guidance/planning on how the organization wishes to use this tool. Presently, providers must leave their clinic and travel to the Telemedicine Clinic when a Telemedicine Consult is needed. The other concern noted was a visible lack of marketing within the medical staff on the advantages of Telemedicine.

We are living in a time where limited resources such as time, manpower, and education are essential for continued success of any organization. Present day technology steals both time and manpower from an already stressed system. If Telemedicine is truly the wave of the future we must develop a strategy to implement a desktop platform along with proper marketing and educational techniques so providers will support and defend the use of Telemedicine.

Of the 2,156 Air-evac outpatients the experts feel that 780 patients or 36% could have been treated via the Telemedicine system if such a system was in place at the originating MTF (Table 4).

Table 4-------------------------Total Air-evacs Vs Total Potential Telemedicine Patients

Medical Specialty	Total Air-evacs	Potential T-med Patients
Hematology/Oncology	576	0
Pediatrics	314	157
Cardiology	253	0
OB/GYN	192	146
Orthopedics	151	151
Ophthalmology	137	84
Dermatology	117	98
Gastroenterology	77	0
Psychiatry	71	71
Urology	56	0
Nephrology	54	36
Neurology	50	0
Internal Medicine	44	22
Infectious Disease	33	0
Rheumatology	31	15
Total	**2,156**	**780**

These 780 patients represent approximately $2.8 million dollars in patient cost and another $200,000 in medical/non-medical attendant cost. Aircraft operation of approximately $1 million dollars could be avoided if we assume that 36% of medevac travel was reduced via the use of Telemedicine. Our total cost avoidance is approximately $4 million dollars.

The Kwajalein Island Project

In January, 1993 Tripler established a Telemedicine link with the U.S. Missile base on the island of Kwajalein, Republic of the Marshall Islands. To date 185 tele-video consultations have been performed encompassing 20 medical specialties.

The data gathered from the Kwajalein Island Project is at best an estimate. The demographic make-up of the patient population is raw and unstable. Due to the local culture and nature of the healthcare system available at this location accurate record keeping is not as sophisticated as seen in the mainland.

In reviewing the historical date concerning the number of referrals off island, the number of medevacs prior to the Telemedicine Clinic were 794. After the implementation of the Telemedicine Clinic that number dropped to 505. It is unclear if the drop can be solely attributed to the Telemedicine Clinic or a healthier population. During the first twelve months of operation the Clinic only conducted 95 video teleconferences. Out of these 95 consults only 40 were estimated to be avoided at a cost avoidance of $85,000.00 dollars (Goodwin 1994).

The cost of medevacs prior to the Telemedicine Clinic is estimated at $1.67 million dollars. One of the problems associated with this cost is the lack of a valid cost outline for

each referral and the numerous insurance plans provided for the contract workers assigned to the island. Telepresence has reduced medevacs and inpatient hospitalizations, but to what extent is unknown. This again is due to the culture of the patient population. The patient culture is also a factor in the satisfaction survey that was attempted with the findings being inconclusive due to the ability of the patient to fully understand the questions and the process of Telemedicine. A repeat survey is scheduled for a later date this year after some careful evaluation.

The in-house findings from this project include a dis-connect between the Telemedicine Clinic and the Air-Evac Office. Presently there is no communication line between these two offices to accurately identify if the tele-video consultation truly resulted in a medevac or non-medevac. This type of follow-up is being addressed within the Telemedicine staff.

Equipment Cost

Telemedicine equipment varies from site to site depending on the mission of the organization. Tripler's Telemedicine Clinic is a "State of the Art" vehicle with a price tag of approximately half a million dollars. The Telepresence equipment Budget & Review list was compiled from TMC's Telemedicine Clinic, Information Management Department, and Resource Management Department.

The telemedicine equipment procurement is provided in three phases to include Entry, Medium and High technology and capability. This budget and equipment proposal will specify the funding and the equipment required for each mission. The initial set-up cost of the telemedicine clinic and subsequent telemedicine program will include the

purchase of portable workstations. These workstations are essential for the management of the program and the successful accomplishment of site surveys associated with remote telemedicine. Also included in the cost of the initial set-up is the cost of furnishing the clinic and the travel associated with the marketing of the program. The equipment needed for the development and implementation of a full service telemedicine clinic is as follows:

Administrative/Clinical Start-Up Estimates:

Item	Quantity	Unit Price	Price
POWERBOOK, DUO 270c w/DOCK AND AV MONITOR	1	$5,000.00	$5,000.00
POWERBOOK, 180C. W/10/200	2	$3,700.00	$7,400.00
FAX MODEM	3	$355.00	$1,065.00
MICROSOFT OFFICE SOFTWARE	3	$465.00	$1,395.00
FILEMAKER PRO SOFTWARE	3	$250.00	$750.00
BATTERIES	6	$80.00	$480.00
CARRYING CASE	3	$73.00	$219.00
LASERWRITER PRO 600	1	$1,900.00	$1,900.00
PORTABLE WRITEMOVE II	1	$548.00	$548.00
PERSONAL LASERWRITER NTR	1	$1,000.00	$1,000.00
FAX MACHINE	2	$400.00	$800.00
20 inch TV/VCR	1	$700.00	$700.00
PRINTER ACCESSORIES	10	$95.00	$950.00
CLINIC SET-UP			
ROOM DIVIDERS/VIDEO DISPLAY SUPPORT	2	$1,500.00	$3,000.00
COMMUNICATIONS:			
DIGITAL PHONE LINES, W/INSTRUMENTS	2		
ANALOG PHONE LINES (FAX)	2		
INITIAL TAD BUDGET	20	$3,000.00	$60,000.00
Administrative Start Up			$85,207.00

ENTRY LEVEL Mission and Equipment:
MISSION: " Store and Forward "

The Entry Level mission and equipment will provide "Store and Forward" technology to the practice of telemedicine. The equipment in this portion of the proposal will provide the ability to electronically obtain voice, image and data transmission, to include radiographic film scanning capability through the use of the Laser Scanner 150 and the Icon Medical Systems equipment. This information can then be stored and forwarded to Tripler across standard, voice grade, telephone lines. This technology is the most conducive to low cost telemedicine and has the capability to be delivered directly to the personal workstation of the physician specialist.

Falcon Microsystems, Inc.

Item	Quantity	Unit Price	Total
Video 8 HandyCam Camcoder	1	$879.00	$879.00
Vdeck Hi8 Video Drive	1	$1,440.00	S1,440.00
Passport Producer Software (Standard w/camera and Quadra 840AV)	1	$0.00	$0.00
VideoVision Studio {Radius Corp. Capture and Display Video)	1	$3,731.00	$3,731.00
Quadra 840AV 16 MB RAM/500 MBHD	2	$3,844.00	$7,688.00
Memory Upgrade/Quadra 800 {64MB RAM)	4	$1,139.00	$4,556.00
Memory Upgrade/Quadra 800 (32MB RAM)	2	$537.00	$1,074.00
Extended Keyboard	2	$153.00	$306.00
Sharevision Camera, Card and Software (Allows view of physician)	2	$2,921.00	$5,842.00

14" Apple Color AV Monitor w/microphone and speakers	2	$700.00	$1,400.00
Proof Positive Full Page SCSI Printer (Photo Grade)	1	$8,460.00	$8.460.00
SuperMac Thunder /24(Video Card)	2	$2,329.00	$4,658.00
Adobe Photoshop 2.5 Mac (Editor for quicktime movies}	2	$528.00	$1,056.00
Kodak Digital Camera System DCS 200CI (Color w/80 MB Internal HD)	1	$8,517.00	$8,517.00
Kodak S/W for Digital Camera System	1	$229.00	$229.00
Adobe Premier 2.0 Mac	2	$428.00	$856.00
Microsoft Office /MAC	2	$457.00	$914.00
Laser Scanner 150	1	$29,000.00	$29,000.00
Macromedia Director Software	1	$800.00	$800.00
DAT Tape Drive (4-8 Gig)	1	$1,200.00	$1,200.00
High Speed Modems (Motorola Codex or Hays eq @ 28KpBS}	2	$500.00	$1,000.00
Sub-Total			$83,606.00

Icon Medical Systems

Item	Quantity	Unit Price	Price
21" Image Systems Portrait Display	2	$2,059.00	$4,118.00
Image Processor Option	2	$800.00	$1,600.00
Telebit T-2500 Modem (19,200 baud)	2	$650.00	t1,300.00
At Ease Software	2	$49.00	$98.00
Computer Security Kit	2	$49.00	$98.00
Power Surge Protector	2	$99.00	$198.00
Remote Service Software	2	$139.00	$278.00
TeleMax 4ch			
DVI Acquisition Station Software	1	$10,000.00	$8,000.00

TeleMax Scanner Add-on Acq Station Software	1	$5,000.00	$3,000.00
4/CH Direct Video Interface Board	1	$5,000.00	$4,000.00
ICON Hi-Res Multi-Monitor Video Board	1	$10,000.00	$8,000.00
TeleMax Dual Monitor Display Station Software	1	$9,000.00	$6,000.00
Sub-Total			$36,690.00
Administrative plus Entry Level Total			$205.503.00

Medium End Mission and Equipment:
MISSION: "Real Time Video with Communications Lines "

The Medium End mission and equipment will add interactive video teleconferencing to the telemedicine session. These portable teleconferencing systems will allow real time interaction between the patient and the physician specialist, technology not available with the "store and forward" system. Real time video will require communication lines with 56 Kbps or higher capability and require the physician specialist to co-locate with the teleconferencing system in TMC.

Compression Labs, Inc.

Item	Quantity	Unit Price	Price
Portable Video Teleconference System	2	$14,900.00	$29,800.00
Integrated Network Interface	2	$2,000.00	$4,000.00
Video Mode Interface	2	$2,000.00	$4,000.00
Adapter Cable	2	$300.00	$600.00
Vhs VSR	2	$900.00	$1,800.00
Remote Control Eclipse 8050	2	$100.00	$200.00
Document Stand	2	$1,200.00	$2,400.00
Total Medium Level			$42,800.00
Administrative Plus Entry and Medium End Total			$248.303.00

High End Mission and Equipment:
MISSION: "Real Time Video with Satellite"

The High End mission and equipment will add the ability to use portable satellite terminals (INMARSAT) for the communications link at up to 56 Kbps. This technology will provide access for the "store and forward" data to be transmitted from anywhere in the world and downloaded to the receiving station located at TMC. The Inmarsat is also capable of transmitting "real time video" from the mobile teleconferencing systems listed in the medium end proposal.

MTI Mobile Telesystems

Item	Quantity	Unit Price	Price
TCS-ultralite	2	$25,000.00	$50,000.00
Administrative plus Entry, Medium, and High End Total			$298,303.00

COMMUNICATION CONNECTIVITY COST

	Installation	Rates
Switched 56 Kpbs		
Dedicated 56 Kbps	$1000.00	$800.00/Month
Dedicated T-1		
Fractional T-1		
Satellite (Inmarsat)	$18/min Full Duplex & Limited Motion Video $5.50/Min Voice	

<u>Summary and Recommendations:</u>

Administrative and Clinical at Entry Level	$205,503.00
Medium End Connectivity	$248,303.00
High End Connectivity	$298,303.00

This budget submission does not take into to account the need for continued emphasis on the hospital infrastructure to make this service available at the desk top of the physicians and staff associated with the telemedicine program. The architectural design of the fiberoptic backbone is $250,000.00. The cost of the cable and installation are estimated to be $750,000.00, bringing the total cost of delivering telemedicine to the desktop of the physician specialist at $1 million.

This project has established a cost avoidance baseline and possible savings through the benefits of telemedicine. This project has identified medical specialties that may benefit from telemedicine, thus reducing costs and lost manpower for that organization. From these findings a foundation can be established to assist the organization in further research into telemedicine.

From this study the cost effectiveness of telemedicine can be determined by comparing the cost avoidance against the equipment start-up expense. The annual cost avoidance dollars for the Pacific Basin is approximately $4 million compared to the high-end equipment start-up expense of approximately $300 thousand. Depending on the size and age of the facility an additional cost of approimately $700K to $1 million is needed for the cable istallation and fiberoptic backbone. This study demonstrates that after the initial one-time start-up cost of approximately $1 million a net avoidance/saving of $3 million will occur.

Recommendations

Telemedicine is not a gimmick. It is slowly becoming a viable tool in the delivery of modern day healthcare. Healthcare executives, providers, and politicians must start working together to enhance the progression of Telemedicine within the DoD/Military Healthcare System.

Presently the only link-up of Telemedicine within the Pacific Basin is between Tripler Medical Center, Honolulu, HI. and the U.S. Army outpatient clinic located in the Kwajalein islands. For the past 24 months telemedicine has been tested from such places as Fort Polk Louisiana, The Northern Pacific Ocean from the U.S. Coast Guard Cutter Rush, and most recently from the 25th I.D. (Light) deployed to Haiti. TMC has proven over and over that Telemedicine works and is a viable tool for providers to practice their art. We must use this tool to the best of it's ability--biggest bang for the buck. The technology is available and it works--we must now use it where the patients are located.

As stated in the findings, the medevac system for the Pacific Basin is centered at Yakota Air Base, Japan. On average Yakota transports over 550 patients and 240 medical attendants per month for an annual average of approximately 10,000 medical evacuations. When we apply our outcome of a 36% reduction against the yearly amount of aerovaced patients we estimate a Pacific Basin cost avoidance of $9 million dollars.

Although the Medical Treatment Facility (MTF) at Yakota is small, its capabilities include an Air Staging Facility (ASF) large enough to berth medevac patients. Additionally, the Yakota medical staff is representative of approximately 70% of the specialties reviewed in this study. If just one Full Motion Video Tele-Conferencing Center

was established at Yakota air Base it would pay for itself within the first year of operation. Recommendations from this study Include:

* First and foremost, establish a Strategic-Business Plan on what the mission and goals of the Tripler's Telepresence unit is within the Pacific Basin

* Market the Mission and Goals internally to introduce, familiarize, and educate staff on the clinical applications. Develop a curriculum for staff clinicians and residents to formalize the training effort and to establish clinical standards and protocols-Credentialling & Privileging

* Research the Federal healthcare marketplace in the Pacific and find opportunities for applying this type of technology to fill needs and solve problems (i.e. studies similar to this GMP)

* Publish papers, present lectures and poster sessions, and pursue other information proliferation activities to inform potential customers of the capabilities available

* Create reimbursement strategies to offset startup and maintenance costs while decreasing the bottom line expenditures

* Conduct research into new technologies in consort with private industry and academic partners and assess the efficacy of technologies

* Work with academic partners and private industry to exploit the promise of the Advanced Communication Technology Satellite (ACTS) the University of Hawaii, Maui, Massive parallel processor Super Computer and other leading edge technology infrastructure in the Pacific

* Prepare research grants application to secure funding for technology assessment efforts

These recommendations are based on research data from the current medevac system, the medical specialties available at Yakota, and the amount of possible cost avoidance captured by the use of Telemedicine.

Conclusion

The uses of telecommunication technology in the delivery of medical care and information are endless. We live in a "High Tech" world that is growing by leaps and bounds leaving a system grasping for rules and guidelines to show us the way. The literature speaks of telemedicine as a rebirth of the modern day "housecall', but lacks a framework of Structure, Process, and Outcome.

Many of the barriers--licensure, reimbursement, and credentialing are major factors as to why a solid framework is not in place. While these barriers frustrate and politically drain the civilian sector DoD healthcare already has in place a "system wide" method of licensure, credentialing, and reimbursement. Although reimbursement is and will continue to be an evolving process; as the use of telemedicine expands the issue of who pays and how much will only muddy the waters.

This project examined 15 medical specialties where Telepresence could impact the diagnosis & treatment of beneficiaries as a new tool in the delivery of healthcare. This research and analysis of data has shown that a cost avoidance/saving can occur if management assumes a pro-active role in the Telepresence efforts in the Pacific Basin.

Of the 15 areas 9 medical specialties were identified in a positive scope where a substantial cost avoidance/savings could occur. This data provides a starting point on where to build a foundation to focus the efforts of future Telepresence Projects. Through the use of imperical data and studies such as this Graduate Management Project (GMP) senior leadership may guide the use of telemedicine in a more cost effective manner.

The problems within DoD healthcare arise from a lack of standardization, guidance, and planning. These problems are found intra-service within MTF's and inter-service between installations/organizations. If telemedicine is going to be a major tool within DoD healthcare we must create a framework which outlines practice protocols, develop processes to educate providers & patients, and establish evidence-based medicine practices to study outcomes.

Note

The opinions or assertions contained herein are the private views of the author and are not to be construed as reflecting the views of Tripler Army Medical Center, U.S. Department of the Army, U.S. Department of the Navy, and the U.S. Department of Defense.

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